

### **2-2.10 Drainage Plans, Details, Profiles and Quantities**

#### **General**

When there is not sufficient space to allow the drainage work to be shown on the project plan layouts, separate drainage plans, profiles, details, and quantity sheets may be used. Drainage work is typically performed by a subcontractor, therefore the work shown on the drainage plans, profiles, details, and quantity sheets should only be related to drainage work.

For convenience, drainage and utilities may be shown on the same sheets since both facilities are typically underground and their locations may be in conflict with each other. Drainage and contour grading also may be shown together on the same sheet.

#### **Drainage Plans**

Drainage plans provide a visual representation in plan view aspect of the drainage facilities. The base mapping for the project layout sheets is typically used as the background for the drainage plans. The background information should be shown in dropped out format and drainage work is shown as solid lines. Drainage plans do not repeat the roadwork items shown on the project plan layouts. If no drainage work is to be performed within the corresponding limits of a project plan layout sheet (road work items), do not include a drainage plan sheet for that area. The number of project plan layout sheets may not be the same as the number of drainage plan sheets.

If a temporary construction easement (TCE) is required for drainage work, show the easement lines on the drainage plan sheet.

See Section 2-1.1 regarding right of way information to be shown.

Existing drainage facilities shall appear as dropped out. If work is to be performed on existing facilities, indicate what type of work is involved, such as "Abandon" or "Remove." The proposed drainage work shall be shown as solid lines. The words "Construct," "Place," etc., for new construction should not be used.

For identification and location purposes, drainage work is to be separated into groupings of interconnected drainage items. Each grouping becomes a drainage system.

A drainage system may consist of a single culvert with or without appurtenances (headwalls, wingwalls, drainage inlets, flared end sections, inlet and outlet structures) or may be a complex system consisting of several culverts and appurtenances feeding into a main culvert.

Where a main culvert (collector) runs the full length of the project or a lengthy portion of the project, the main culvert and related appurtenances should be broken into more than one system and assigned more than one drainage system number. The breaks to identify each of these systems should be at a distinct point, such as a drainage inlet, cleanout, junction structure, profile grade change, etc.

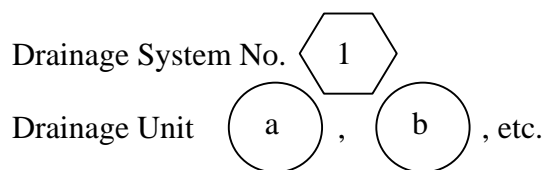
A drainage system number shall be assigned to each drainage system on the project where work is to be performed. Drainage system numbering shall be consecutive throughout the project. System numbering should not start and stop for each individual sheet of drainage plans.

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If a drainage system is added after final district review, don't renumber all the systems. Use the next drainage system number occurring after the last one used on the project. If a system is deleted, insert a note in the description column of the drainage quantity sheet for the deleted system (example: "Drainage System No. 13 deleted").

Each drainage system shall be identified by a number, and each item of the system shall be assigned a drainage unit designation and shall be labeled as shown in the following example:



Generally, the number of units in a system should not exceed the single alpha unit code (a through z). In extreme cases, use a double alpha unit code when the number of drainage units exceeds 26.

Typically, the coding of drainage units should begin with the main feature of the drainage system and progress from there. Coding of units may also start at the lowest point of a cross drain and progress to the highest point. The method of coding drainage units is to be consistent throughout the project.

Labeling of drainage units on the drainage plans should be generic, use terms such as: Culv, DD, DI, FES, Jct Str, OD, RSP, etc. Full details of all drainage system items with type and size labeling are to be shown on the drainage profiles.

The drainage system number and unit designation on the drainage plans shall correspond with those shown on the drainage profiles, drainage details and drainage quantities.

The station reference to be shown for a drainage system is the point at which the culvert crosses or intersects the roadway station line or profile grade. Where a culvert does not cross or intersect the roadway station line or profile grade, the culvert shall be referenced to the nearest roadway station line by station pluses and station offset distances.

Indicate ditches by standard symbols with arrowheads to show direction of flow. Flow arrows are often helpful at inlet and outlet structures.

Subsurface drains such as edge drains, pavement structure drains, horizontal drains, and underdrains should be shown on the project plan layouts. If there is not sufficient space for this type of work to be shown on the project plan layouts, it may be shown on the drainage plan sheets. Where subsurface drainage systems are large and complex, separate subsurface drainage plan sheets may be used. If separate subsurface drain plans are used, the subsurface drain details and the summary of subsurface drain quantities table shall immediately follow the subsurface drain plans. If subsurface drains are shown on the project plan layouts or drainage plan sheets, the subsurface drainage items shall be summarized in a table on the project's summary of quantities sheet. For additional information regarding subsurface drainage, see Section 2-2.11 of this manual.

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The first sheet of drainage plans should contain notes, legends, symbols, and a list of abbreviations. Do not include standard plan abbreviations or acronyms as part of the listed abbreviations.

Each sheet of the drainage plans shall have the following note included on them: "THIS PLAN ACCURATE FOR DRAINAGE WORK ONLY."

### Drainage Profiles

Drainage profiles must contain the data necessary to install and construct new drainage facilities. Where existing drainage facilities are to be removed, the typical cover (vertical distance from the top of the facility to original ground) must be shown on the drainage profiles or in the drainage quantities list.

The minimum height (thickness of cover) for pipe culverts is discussed in Topic 854.9 and shown in Table 854.9 of the Highway Design Manual.

Drainage profiles provide the means of determining the quantity of excavation and backfill needed to install, construct or remove a drainage facility. Structure excavation and structure backfill is included in the item or items of work to install, construct or remove a drainage facility.

Drainage profiles of cross drains shall be displayed in the direction of increasing stations. Profiles should be arranged to best fit within the area available on the profile sheet.

The following data is to be given for the units of each drainage system:

- Type, size, length, and location of culverts (station pluses and station offset distance)
- Culvert appurtenances, such as headwalls, wingwalls, drainage inlets, flared end sections, inlet and outlet structures, shown and labeled. Identify location of items by plus station and station offset distance.
- Existing groundline profile (shown as dashed line) and finished grade (shown as solid line).
- All flow line elevations. The slope of the culvert shall be shown by percentage or decimal and shall be consistent throughout the profiles. For consistency, care shall be taken with significant figures. One significant figure right of the decimal point when using percent and three significant figures right of the decimal point when using decimal slopes.

Drainage system numbers and unit designations on the profiles must correspond with drainage plan sheets, drainage details, and quantities summary sheets.

The estimated slope length of pipe in a drainage unit shown on the drainage profile sheet shall be the centerline length of the culvert expressed in decimal feet, to the nearest tenth of a foot. Where the pipe is placed between successive drainage structures (inlets, junction boxes, etc.), the slope length of pipe shown should be the centerline length between the inside face of each structure.

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The length of pipe shown on the drainage profile for each culvert shall be the same as that entered in the drainage quantity sheet.

The final pay length for each culvert installed during construction will be determined in accordance with the Standard Specifications and the instructions in the Construction Manual.

### Drainage Details

The details shown on the drainage detail sheets usually depict special drainage structures, channel changes, modifications to existing structures, etc.

Drainage detail sheets should not be confused with drainage plan sheets. Drainage plan sheets show layouts of drainage systems.

The details shown on the drainage detail sheets are unique to a specific project and those for which there are no standard plans, or may be a detail from a standard plan which must be modified to fit site conditions.

When a small part of a Standard Plan drawing must be modified and included in the project plans, only the affected dimensioning should be shown and a reference made to the applicable Standard Plan sheet. If a Standard Plan drawing needs substantial modification and is included in the project plans, the modified detail should be fully dimensioned and no reference made to the associated standard plan.

Drawings on the drainage detail sheets are typically not drawn to a specific scale. Drawings are usually drawn at a one to one proportion, but then enlarged to fit the border sheet. Each sheet is to be labeled

"No Scale." Sufficient dimensioning shall be shown on the details so that the facilities are buildable and the quantities are calculable.

Standard drawings of other agencies, when applicable to the project, shall be included as part of the project plan set. Referencing to a standard drawing number from another agency is not acceptable.

Drainage details which are applicable to a specific drainage system should be identified on the drainage detail sheet by the corresponding drainage system number and unit designation. Drainage system number and unit designation must correspond with drainage plan sheets, profiles and quantities summary sheets. If a drainage detail applies to several drainage systems, only show those drainage system numbers with that detail.

### Drainage Quantities

#### *General*

This sheet consists of a summary of drainage facilities and appurtenances (headwalls, wingwalls, drainage inlets, flared end sections, inlet and outlet structures, etc.), which are to be constructed, installed, removed, reset, remodeled, adjusted, modified, abandoned, reconstructed, or salvaged as shown on the drainage plans or in some instances where shown on the project plan layouts.

#### *Referencing Drainage Facility*

Drainage facilities shall be referenced on the drainage quantities table by:

- Station,
- Drainage system number,
- Drainage unit designation, and
- Drainage plan sheet number.

The station reference used for a drainage system is the point at which the culvert crosses or intersects the roadway station line or profile grade. Appurtenances (headwalls, wingwalls, drainage inlets, flared end sections, inlet and outlet structures, etc.) for these culverts shall be listed together using the single reference station of the culvert, regardless of skew or distance from roadway station line.

Where a drainage system consists of a culvert installed in the median or in roadside areas, approximately parallel to the roadbed, the culvert shall be referenced to the roadway station line by station pluses and station offset distances. The station pluses and station offset distances shall be to:

- the end of the culvert where no appurtenance is attached to the end of the culvert,  
or
- the appurtenance (headwall, drainage inlet, flared end section, inlet or outlet structure) attached to the end of the culvert.

Downdrains shall be referenced to the nearest control line station. Station references shall match those shown on the drainage plan sheet and drainage profile sheet.

The drainage system number and unit designation must correspond with drainage plan sheets, drainage profile sheets, and drainage detail sheets.

### ***Column Headings and Content of Columns***

Station, drainage system number, drainage unit designation, and drainage plan sheet number shall be the column headings on the

right side of the table. Where sufficient space is available on the sheet, the drainage system number, drainage unit designation, and drainage plan sheet number may be duplicated on left side of the table for easier cross reference. See the drainage quantities sheet examples.

A description column shall be provided on the drainage quantities table showing name, size, type, or classification of all units of each drainage system. The description column shall be on the right side of the table preceding the column headings for station, drainage system number, drainage unit designation, and drainage plan sheet number. Units of each drainage system, which require separate calculations for pay quantities, such as a headwall or a drainage inlet, shall be listed on their own individual row. Culvert appurtenances such as elbows, which are measured and paid for by the linear foot for the size and type of pipe involved, may be listed on the same row as the culvert. At least one row of space shall be provided between each listing of drainage systems in the table.

Individual columns shall be provided on the drainage quantities table for all drainage facilities that are pay items. Items of like or related nature should be grouped together to facilitate checking and for ready reference.

The column headings for pay items shall read the same as the description for the pay item shown in the Engineer's Estimate. The column headings for the drainage quantities table shall be the same on all sheets of the summary to facilitate checking item totals.

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Individual columns shall be provided for the various existing drainage facilities, which are to be removed, abandoned, salvaged, reset, remodeled, adjusted, modified, or reconstructed. Remodeling, adjusting, or modifying existing concrete drainage inlets may be paid for by the cubic yard of minor concrete (minor structure) necessary to perform the work involved or may be paid for by the unit (each).

Individual columns are to be provided for items, such as flared end sections, pipe downdrains, downdrain slip joints, downdrain anchors, entrance tapers, rock slope protection, and concrete used for slope protection, gutter lining, ditch lining, and channel lining. Such concrete is not to be designated by class or as minor concrete in the Engineer's Estimate or on the plans. The Standard Specifications allows the option of either Class 3 concrete or minor concrete to be used for slope protection, gutter lining, ditch lining, and channel lining.

Drainage work that is included in another pay item and not paid for separately, but shown in a column, should be indicated with the symbol "(N)" in the column heading and by adding the following note to the sheet:

(N) = Not a separate pay item, for information only.

Certain pay items such as "minor concrete (minor structure)" and "miscellaneous iron and steel" are usually designated as final pay quantities. Final pay quantities are only to be designated in the Engineer's Estimate using the symbol "(F)." Do not use final pay designation on the plans.

### *Pipe Culverts*

Individual columns shall be provided in the table for each size and type of pipe culvert.

Circular reinforced concrete pipe shall be shown by size only, where the method of excavation and backfill shown on the Standard Plans apply. In such cases, the contractor will select the class of circular reinforced concrete pipe. Where circular reinforced concrete pipe is to be installed by other methods, the size and class of the circular reinforced concrete pipe shall be shown in the column headings. Oval shaped reinforced concrete pipe and reinforced concrete pipe arch shall be shown by size and class.

Corrugated metal pipe culvert (steel or aluminum) shall be shown by size of pipe and wall thickness. Corrugation type (annular and/or helical) should be shown. The maximum height of cover (overfill height) for a metal pipe culvert is directly tied to its wall thickness, corrugation profile and type of corrugation. Where metal pipes require bituminous coating, lining, or invert paving, show them as such in the column heading for the pipe culverts involved.

The length of pipe culvert for each individual drainage unit shown on the drainage quantities sheet shall be the same estimated slope length (decimal feet expressed to the nearest tenth of a foot) of the pipe shown on the drainage profiles.



Where two or more pipe materials meet the physical standards and hydraulic requirements for a culvert, the culvert shall be identified as alternative pipe culvert. A table of allowable pipe materials for alternative pipe culvert, designating the type of material, size, class (when applicable), thickness, and protection shall be shown on the first sheet of the drainage details or drainage quantities. Refer to Topic 853.3 of the Highway Design Manual.

An individual column shall be provided in the table and identified as "Maximum Cover." The entries in this column indicate the maximum cover over each length of circular reinforced concrete pipe culvert (or alternative pipe culvert where circular reinforced concrete pipe is an allowable alternative). Cover is defined as the maximum vertical distance from the top of pipe to finished grade. The maximum height of cover shall be shown to the nearest tenth of a foot, since the class of reinforced concrete pipe to be installed depends on the method of excavation and backfill, and the limits of cover as set forth in the Standard Plans.

An individual column shall be shown in the table for pipe culvert joint classification (standard, positive, or down drain). Where situations dictate watertightness for joints other than the down drain type, a note should be added to the table in the description column indicating which joints are to be made watertight.

Structure excavation, structure backfill, and culvert beddings required for installation of culverts shall not be shown on the drainage quantities table. These items are not paid for separately. They are included in the contract price paid per linear foot for the culvert involved.

Where concrete backfill is used to install a culvert, the concrete backfill is to be paid for separately and such quantity of concrete backfill shall be shown in the drainage quantities table.

Structure excavation, structure backfill, and pervious backfill required for construction of culvert headwalls, endwalls, and wingwalls shall not be shown on the drainage quantities table. These items are not paid for separately. The items of structure excavation, structure backfill and pervious backfill are included in the contract price paid per cubic yard for the concrete to construct such facilities.

Headwalls and endwalls, as shown on Standard Plan D89 are, in most instances, paid for by the cubic yard as minor concrete (minor structure). The quantities for these headwalls and endwalls shall be listed under the column heading of "Minor Concrete (Minor Structure)" and should be shown to the nearest hundredth of a cubic yard.

Headwalls, endwalls, and warped wingwalls for pipe culverts 60 inches and greater in diameter are paid for by the cubic yard of concrete (usually Class 1 concrete) and by the pound for bar reinforcing steel required for construction of such facilities. Quantities of concrete should be shown to the nearest tenth of a cubic yard.

### ***Concrete Drainage Inlets, Pipe Inlets and Risers***

Pipe inlets and pipe risers shall be shown under individual columns for the size, type, and thickness (where applicable). The dimension shown in the entries for the individual pay lengths is the 'H' dimension expressed to the nearest tenth of a foot. Typically, concrete bases for pipe inlets and pipe risers are paid for separately as concrete (minor structure). The quantities for the concrete bases shall be listed under the column heading of "Concrete (Minor Structure)" and quantities should be shown to the nearest hundredth of a cubic yard.

An individual column shall be provided in the table as "Height of Inlet." This is the 'H' dimension of drainage inlets as depicted on the Standard Plans for drainage inlets. The dimension to be included in the "Height of Inlet" column shall be the calculated height rounded to the nearest tenth of a foot increment. The "Height of Inlet" column is needed for both construction and removal of drainage inlets.

Minor structures, such as concrete drainage inlets are, in most instances, paid for by the cubic yard as minor concrete (minor structure). The quantities for the concrete drainage inlets shall be listed under the column heading of "Minor Concrete (Minor Structure)" and quantities should be shown to the nearest hundredth of a cubic yard.

Frames, grates, and covers for drainage inlets (both concrete and pipe inlets) are normally paid for by the pound as miscellaneous iron and steel. A separate column should be used for the item of miscellaneous iron and steel. The type of grate may be shown in a separate column or

may be referred to in the description column.

### ***Reinforced Concrete Box and Arch Culverts***

Cast-in-place reinforced concrete box culverts and reinforced concrete arch culverts and associated headwalls, wingwalls, endwalls, and warped wingwalls are paid for by the cubic yard of concrete (usually Class 1 concrete) and by the pound for bar reinforcing steel required for construction of such facilities. Quantities shall be shown in the columns for Class 1 concrete (structure) and bar reinforcing steel. Quantities of concrete should be shown to the nearest tenth of a cubic yard.

When conditions require isolation of quantities for construction of specific structures, the column headings and items of work may be more specialized. Example: the item of Class 1 concrete (box culvert) could be used for the quantity of concrete to construct box culverts instead of grouping that quantity with the general item of Class 1 concrete.

Precast reinforced concrete box culverts are paid for by length (linear foot).

### ***Drainage Quantity Totals***

Where all of the drainage quantities can be shown in a table on one quantity sheet, quantity totals for each pay item column shall appear at the bottom of the table.



Where more than one sheet is necessary to show drainage quantities, the totals for each pay item shall appear at the bottom of the table on each individual sheet. The totals for the pay items shall be identified as "SHEET TOTALS." Sheet totals for each pay item shall appear on the last sheet of the drainage summary of quantities. Sheet totals shall be totaled and shown as "GRAND TOTAL" or "TOTAL."

Where there is not sufficient space on a single border sheet to accommodate the number of columns necessary to list all of the project's drainage items, two sheets may be used to display the listing of items. If this occurs:

- Items of like or related nature should be grouped together to facilitate checking and for ready reference.
- The first grouping of drainage items (by columns) shall be shown on the first sheet of the drainage quantities, "DQ-1" and shall be repeated on the odd numbered ID code sheets (DQ-3, DQ-5, etc.).
- The remaining group of drainage items (by columns) shall be shown on the second sheet of the drainage quantities, "DQ-2" and shall be repeated on the even numbered ID code sheets (DQ-4, DQ-6, etc.).
- The reference information entered within the columns labeled "station," "drainage system number," "drainage unit designation," and "drainage plan sheet number" which is shown on the first sheet of the drainage quantities, "DQ-1" shall be repeated on sheet DQ-2 to provide continuity. The reference information entered within these columns on sheet DQ-3 will match that shown on DQ-4. The remaining sheets will follow this same sequence.

- This explanatory note should be added to the first sheet of the drainage quantities: "Sufficient space was not available to list all drainage items within a single table on a sheet border, therefore the listing of the first grouping of drainage items are repeated on the odd numbered ID code sheets (DQ-1, DQ-3, etc.) and the listing of the remaining group of drainage items are repeated on the even numbered ID code sheets (DQ-2, DQ-4, etc.)."

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### CHECKLIST FOR DRAINAGE PLAN SHEETS

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| <ul style="list-style-type: none"><li><input type="checkbox"/> District, county and route TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet)</li><li><input type="checkbox"/> Post Miles TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet)</li><li><input type="checkbox"/> CU No. and EA No. (lower right corner of sheet) TX=7.0, FT=3, WT=1, LV=10</li><li><input type="checkbox"/> Signature only included on Level 63. Date of signature and current registration seal information included on Level 10, (lower right corner of sheet). Drafting reviewers will attach signatures when project goes to PS&amp;E. Text height should be 7, but the width can be squeezed to fit the area using element selection. If both names are long, the first name can be above the last name. FT=3, WT=1</li><li><input type="checkbox"/> Standard north arrow (AC = NARR)</li><li><input type="checkbox"/> Scale horizontal (TX=8.75, FT=3, WT=2, LV=10)</li><li><input type="checkbox"/> Information inserted in plan sheet development name block spaces in left margin of sheet. See Figures 2-10 and 2-11 in Section 2-1.6 of this manual for additional instructions.</li></ul> | <ul style="list-style-type: none"><li><input type="checkbox"/> The following note shall be shown on each drainage plan sheet that shows right of way and easement lines: "For complete right of way and accurate access data, see right of way record maps at district office." In the case of a conventional highway, omit the words "and accurate access." Include this note on any other plan view sheet that shows right of way lines.</li><li><input type="checkbox"/> Temporary construction easement (TCE) lines shown for drainage work if TCE required</li><li><input type="checkbox"/> First sheet of drainage plan sheets contains notes, legends, symbols, and a list of abbreviations (do not include standard plan abbreviations as part of the listed abbreviations)</li><li><input type="checkbox"/> Drainage work separated into groupings of interconnected drainage items</li><li><input type="checkbox"/> Drainage system numbers and drainage units identified by symbol and coding as provided under "Drainage Plans" of this section of the manual</li><li><input type="checkbox"/> Drainage items of work labeled generically (Culv, DI, etc.)</li><li><input type="checkbox"/> Type of work on existing facilities indicated (Remove, Abandon , Adjust, etc.). Words such as "Construct, "Place," etc. not used for new construction.</li></ul> |
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### CHECKLIST FOR DRAINAGE PLAN SHEETS

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- ☐ Alignment lines used for referencing of drainage facilities shown
- ☐ The station reference for each drainage system shown (the point at which the culvert crosses or intersects the roadway station line or profile grade)
- ☐ Where a culvert does not cross or intersect the roadway station line or profile grade, the culvert is referenced to the nearest roadway station line by station pluses and station offset distances.
- ☐ Direction of flow identified for ditches, channels, etc.
- ☐ Waterways (stream, creek, river, etc.) and direction of flow shown
- ☐ Subsurface drain locations, including types of outlets, vents and cleanouts shown, if subsurface drains not shown on project layouts. If sufficient space is not available on drainage plans, subsurface drains may be shown on separate subsurface drain plans.

### CHECKLIST FOR DRAINAGE

#### PROFILE SHEETS

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| <p><input type="checkbox"/> District, county and route TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet)</p> <p><input type="checkbox"/> Post Miles TX=7.0, FT=3, WT=1, LV=10 (upper right corner of sheet)</p> <p><input type="checkbox"/> CU No. and EA No. (lower right corner of sheet) TX=7.0, FT=3, WT=1, LV=10</p> <p><input type="checkbox"/> Signature only included on Level 63. Date of signature and current registration seal information included on Level 10, (lower right corner of sheet). Drafting reviewers will attach signatures when project goes to PS&amp;E. Text height should be 7, but the width can be squeezed to fit the area using element selection. If both names are long, the first name can be above the last name. FT=3, WT=1</p> <p><input type="checkbox"/> Information inserted in plan sheet development name block spaces in left margin of sheet. See Figures 2-10 and 2-11 in Section 2-1.6 of this manual for additional instructions.</p> <p><input type="checkbox"/> Scale – vertical and horizontal</p> <p><input type="checkbox"/> Drainage System No. shown with station reference of system</p> <p><input type="checkbox"/> Drainage unit designations shown for each item of the system (headwalls, wingwalls, drainage inlets, flared end sections, inlet and outlet structures)</p> <p><input type="checkbox"/> Location of each item of each system identified by station and offset distances from station</p> | <p><input type="checkbox"/> Profile line of drainage facility with percent or decimal grade shown</p> <p><input type="checkbox"/> Inlet and outlet elevations of drainage facilities</p> <p><input type="checkbox"/> Existing groundline profile (dashed line) and finished grade (solid line) shown and labeled</p> <p><input type="checkbox"/> Datum elevations at both edges of sheet (on top of the horizontal grid line)</p> <p style="text-align: center;"><i>Pipe Culverts</i></p> <p><input type="checkbox"/> Corrugated metal pipe culvert (steel or aluminum) and circular reinforced concrete pipe shown by diameter and length</p> <p><input type="checkbox"/> Oval shaped reinforced concrete pipe and reinforced concrete pipe arch shown by span, height and length</p> <p><input type="checkbox"/> Alternative pipe culvert shown by diameter and length</p> <p><input type="checkbox"/> Inlet and outlet elevations of pipe culvert shown</p> <p><input type="checkbox"/> Inlet and outlet facility, if any, attached to ends of pipe culvert shown (flared end section, headwall, endwall, drainage inlet, etc.)</p> <p style="text-align: center;"><i>Concrete Drainage Inlets, Pipe Inlets and Risers</i></p> <p><input type="checkbox"/> Pipe inlets shown by size, type and length (pay length equals "H" dimension expressed to tenth of a foot), concrete bases for pipe inlets shown</p> |
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### CHECKLIST FOR DRAINAGE PROFILE SHEETS (Page 2 of 2)

- ☐ Pipe inlet with grate – Type of grate, inlet elevation of top of grate and outlet elevation of inlet shown
- ☐ Pipe inlet with side opening(s) and cover on top of inlet – Type of cover, inlet elevation of side opening(s) and outlet elevation of inlet shown
- ☐ Concrete drainage inlets shown by type (G1, GO, SO, OL-7, GT1, etc.) and "H" dimension expressed to tenth of a foot
- ☐ Concrete drainage inlets with grate – Type of grate, inlet elevation of top of grate and outlet elevation of inlet shown
- ☐ Concrete drainage inlets with side opening(s) and cover on top of inlet – Type of cover, inlet elevation of side opening(s) and outlet elevation of inlet shown
- ☐ Pipe risers shown by size, type and length (pay length equals "H" dimension expressed to tenth of a foot)

#### *Box Culverts*

- ☐ Reinforced concrete box culvert shown by span, height and length. Number of cells shown: single, double, etc.
- ☐ Inlet and outlet elevations of box culvert shown
- ☐ Type of wingwalls for each end of box culvert shown ("A," "B," "C," "D," "E," warped)

- ☐ Wingwall "H" dimensions shown
- ☐ Elevation "a" shown for warped wingwalls

#### *Ditches and Channels*

- ☐ Profile line of facility with percent or decimal grade shown, if profile not shown on roadway profile sheets
- ☐ Typical cross section of facility shown, if not shown on roadway profile sheets or drainage details. Where facility is lined, show type of lining, thickness of lining, and details of construction joints, cut-off stubs and end return.
- ☐ Inlet and outlet facility, if any, shown and dimensioned

#### *Slope Protection*

- ☐ Type, length and arrangement of slope protection shown
- ☐ Typical cross section of facility shown, if not shown on roadway profile sheets or drainage details. Where facility is lined, show type of lining, thickness of lining, and details of construction joints, cut-off stubs and end return. Where rock slope protection (RSP) is used, show RSP fabric, thickness of rock layers, and classification of rock layers.